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1958 Agreement:
Consideration of draft amendments
to existing UN Regulations submitted by GRSG

Proposal for Supplement 15 to the 01 series of amendments to UN Regulation No. 67 (LPG vehicles)

Submitted by the Working Party on General Safety Provisions*

The text reproduced below was adopted by the Working Party on General Safety Provisions (GRSG) at its 113th session (ECE/TRANS/WP.29/GRSG/92, paras. 31, 32, 34 and 35). It is based on official documents ECE/TRANS/WP.29/GRSG/2017/26 as amended by paragraph 31 of the report, on ECE/TRANS/WP.29/GRSG/2017/27 as amended by paragraph 32 of the report and on ECE/TRANS/WP.29/GRSG/2017/30 as amended by paragraph 34 of the report. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee AC.1 for consideration at their March 2018 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2016–2017 (ECE/TRANS/254, para. 159 and ECE/TRANS/2016/28/Add.1, cluster 3.1), the World Forum will develop, harmonize and update UN regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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Please recycle

Supplement 15 to the 01 series of amendments to UN Regulation No. 67 (LPG vehicles)

List of contents, Annexes, amend to read:

"Annexes

...

14 Provisions regarding the approval of the electronic control unit

15 Provisions regarding the approval of gas tube(s) of non-seamless type, gas tube(s) made of materials other than copper, stainless steel, and steel with corrosion-resistant coating, and their couplings

16 Test procedures

17 Provisions regarding LPG identification mark for M_2 and M_3 category vehicles

18 Provisions regarding identification mark for service coupling

19 Provisions on the compatibility of metallic and non-metallic components and parts with petrol

20 Provisions on interconnected LPG-systems"

Paragraph 2.2., amend to read:

"2.2. *"Specific equipment"* means:

(a) The container;

(b) The accessories fitted to the container;

(c) The vaporizer/pressure regulator;

(d) The shut-off valve;

(e) The gas injection device or injector or gas mixing piece;

(f) The gas dosage unit either separate or combined with the gas injection device;

(g) Flexible hoses;

(h) Filling unit;

(i) Non-return valve;

(j) Gas-tube pressure relief valve;

(k) Filter unit;

(l) Pressure or temperature sensor;

(m) Fuel pump;

(n) Service coupling;

(o) Electronic control unit;

(p) Fuel rail;

(q) Pressure relief device;

(r) Multi-component;

(s) Non-seamless and seamless gas tubes and their couplings;

(t) Gas tubes made of materials other than copper, stainless steel, and steel with corrosion-resistant coating and their couplings."

Insert new paragraphs 2.21. to 2.24., to read:

"2.21. *"LPG-system"* means a set of LPG specific equipment intended to be fitted in a vehicle to constitute an integrated and functional whole aimed at enabling the propulsion with LPG;

2.22. *"Interconnected LPG-system (ICS)"* means a LPG-system having hydraulic interconnections with the petrol or diesel fuelling system;

2.23. *"Multi-component"* means any of the above mentioned specific components combined or fitted together as a component.

2.24. *"Gas tube"* means tubing made of metallic material which has been designed not to flex in normal operation and through which LPG flows."

Paragraph 4.2., amend to read:

"4.2. All equipment shall have ..... drawings referred to in paragraph 3.2.2. above. In the case of limited space for the approval mark(s), other means of identification that link it to the approval mark shall be provided."

Paragraphs 6.4. to 6.14. (former), amend to read (inserting news paragraphs 6.15. and 6.16.):

"6.4. - 6.16. Provisions regarding other components

The other components, which are shown in Table 1 ... from the table.

Table 1

Paragraph	*Component*	*Annex*
6.4.	Fuel pump	4
6.5.	Vaporizer[1] Pressure regulator[1]	6
...	...	...
6.9.	Gas injection devices/Gas mixing piece[1] or Injectors	11
6.10.	Gas dosage units[2]	12
...	...	...
6.14.	Pressure relief device	3
6.15	Gas tube(s) of non-seamless type, gas tube(s) made of materials other than copper, stainless steel, and steel with corrosion-resistant coating, and their couplings	15
6.16.	Multi-component	Annexes applicable to the single components

[1] Either combined or separate.

[2] Only applicable when the gas dosage actuator is not integrated in the gas injection device.

[3] Applicable only when the operating pressure of the gas mixing piece exceeds 20 kPa (Class 2).

"

Paragraphs 6.15. to 6.15.3.2. (former), renumber as paragraphs 6.17. to 6.17.3.2.

Insert a new paragraph 6.17.3.3., to read:

"6.17.3.3. Without prejudice to paragraph 1.7. of Annex 7 of this Regulation (commanded stop phases), a remotely controlled shut-off valve (when intended to be fitted as a component of an interconnected LPG-system for the purpose of paragraph 17.13.2.2.) shall be submitted, during approval, to an endurance test according to paragraph 9. of Annex 16 with a number of cycles equal to 20,000.

The valve shall bear a marking with the following data clearly legible and indelible:

(a) The wording "ICS", and

(b) The approval mark according to paragraph 5.4. of this Regulation."

Paragraphs 6.15.4. to 6.15.13.2.4. (former), renumber as paragraphs 6.17.4. to 6.17.13.2.4.

Insert new paragraphs 6.17.14. and 6.17.14.1., to read:

"6.17.14. Provisions regarding non-return valves

6.17.14.1. When a non-return valve is intended to be fitted as a component of an interconnected LPG-system for the purpose of paragraph 17.13.1.1., 17.13.1.2. or 17.13.2.1., it shall be submitted, during approval, to an endurance test according to paragraph 9.7. of Annex 16.

The valve shall bear a marking with the following data clearly legible and indelible:

(a) The wording "ICS", and

(b) The approval mark according to paragraph 5.4. of this Regulation."

Insert a new paragraph 6.18., to read:

"6.18. When intended to be fitted as components or parts of an interconnected LPG-system, non-metallic, metallic or a mixture of metallic and non-metallic LPG components, including flexible hoses and their elements, and non-metallic, metallic or a mixture of metallic and non-metallic parts of LPG components which may come into contact with petrol shall meet the requirements specified in Annex 19 to this Regulation.

Non-metallic, metallic or a mixture of metallic and non-metallic components or components containing non-metallic parts shall bear an approval mark according to Annex A, Appendix 1."

Paragraph 9.3., renumber the reference to "Annexes 8, 10 and 15" to read "Annexes 8, 10 and 16".

Paragraph 17.1.7.5., renumber the reference to Annex 17 to read Annex 18.

Paragraph 17.1.8.1., renumber the reference to Annex 16 to read Annex 17.

Paragraph 17.7.1., amend to read:

"17.7.1. Gas tubes of seamless type made of either copper or stainless steel or steel with

corrosion-resistant coating."

Insert new paragraphs 17.7.1.1. and 17.7.1.2., to read:

"17.7.1.1. If seamless copper is used the tube shall be protected by a rubber or plastic sleeve.

17.7.1.2. The outer diameter of Class 1 gas tubes made of copper shall not exceed 12 mm with a wall thickness of at least 0.8 mm. gas tubes of Class 1 from steel and stainless steel shall not exceed 25 mm with, for gas services, an appropriate wall thickness."

Paragraph 17.7.2., amend to read

"17.7.2. Gas tubes of seamless type made of materials other than those of paragraph 17.7.1. shall comply with the applicable tests according to the provisions of Annex 15"

Paragraph 17.7.3., amend to read

"17.7.3. Gas tubes of non-seamless type shall comply with the applicable tests according to the provisions of Annex 15."

Paragraph 17.7.4., amend to read

"17.7.4. Gas pipes made of a non-metallic material shall comply with the requirements of this Regulation, paragraph 6.7."

Insert new paragraphs 17.13. to 17.13.2.5., to read:

"17.13. Specific provisions for interconnected LPG-systems

17.13.1. LPG-system for dual-fuel (LPG-diesel) vehicle

17.13.1.1. Means shall be provided to prevent any flow of LPG into the diesel tank. The installation of two non-return valves along the flow line shall be considered as meeting this requirement if the valves comply with the provisions of paragraph 6.17.14.1.

17.13.1.2. Means shall be provided to prevent any flow of diesel into the LPG container. The installation of two non-return valves along the flow line shall be considered as meeting this requirement if the valves comply with the provisions of paragraph 6.17.14.1.

17.13.2. LPG-system for bi-fuel (LPG-petrol) vehicle

17.13.2.1. Means shall be provided to prevent any flow of LPG into the petrol tank. The installation of two non-return valves along the flow line shall be considered as meeting this requirement if the valves comply with the provisions of paragraph 6.17.14.1.

17.13.2.2. In order to prevent that flows of petrol into LPG container, occurring during switch-over operations, could lead to an overfilling of the LPG tank (i.e. above 80 per cent of its capacity which means 80 per cent liquid and 20 per cent gaseous fuel), the LPG-system shall contain an Electronic Control Unit complying also with paragraph 6. of Annex 14.

A remotely controlled shut-off valve complying with the provisions of paragraph 6.17.3.3. shall be installed along the flow line.

17.13.2.3. Means shall be provided to prevent that flows of petrol into the LPG fuel container could lead to a content of petrol higher than 16 per cent of the actual volume contained in the LPG tank.

This measure shall be demonstrated in accordance with the procedures laid down in Annex 20.

The present requirement shall be fulfilled also in case of faults by use of a malfunction indication to the driver, and optionally activation of limp home mode.

17.13.2.4. Non-metallic, metallic or a mixture of metallic and non-metallic LPG components, including flexible hoses and their elements, and non-metallic, metallic or a mixture of metallic and non-metallic parts of LPG components which may come into contact with petrol shall comply with the requirements set out in paragraph 6.18.

17.13.2.5. The ECU complying with the requirements of paragraph 17.13.2.2. shall be installed:

(a) In vehicles where the flushed volume is less than or equal to 0.4 litre; and

(b) In vehicles equipped with a LPG container having a capacity higher than 20 litres."

Annex 1

Insert new items 1.2.4.5.19. to 1.2.4.5.19.3., to read:

"1.2.4.5.19. Non-seamless gas tubes and their couplings

1.2.4.5.19.1. Make(s): .....

1.2.4.5.19.2. Type(s): .....

1.2.4.5.19.3. Description and drawings: ....."

Insert new items 1.2.4.5.20. to 1.2.4.5.20.3., to read:

"1.2.4.5.20. Seamless gas tubes made of materials other than copper, stainless steel and steel with corrosion-resistant coating and their couplings

1.2.4.5.20.1. Make(s): .....

1.2.4.5.20.2. Type(s): .....

1.2.4.5.20.3. Description and drawings: ....."

Items 1.2.4.5.19. to 1.2.4.5.19.5. (former), renumber as items 1.2.4.5.21. to 1.2.4.5.21.5.

Add new items 1.2.6. and 1.2.7., to read:

"1.2.6. Documentation of the provisions and system description/drawings to avoid overfilling of the LPG tank (paragraph 17.3.2.2.): .....

1.2.7. Documentation of the provisions for interconnected LPG systems (Annex 20): ....."

Annex 2A, amend to read:

"Annex 2A

Arrangement of the LPG equipment type approval mark

(See paragraph 5.4. of this Regulation)

67 R—012439 CLASS #[1] * A[2]

a ≥ 5 mm

[1] Class 0, 1, 2, 2A or 3.

[2] Indication mark of technical modification to be marked only on multivalve or, when approved separately, on pressure relief valve (discharge valve) and pressure relief device.

The above approval mark affixed to the LPG equipment shows that this equipment has been approved in the Netherlands (E 4), pursuant to UN Regulation No. 67 under approval number 012439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of UN Regulation No. 67 as amended by the 01 series of amendments. The indication mark of technical modification (A in the example), preceded by the star symbol, is required only for the approval mark of the accessories of the container (multivalve or, when approved separately, pressure relief valve (discharge valve) and pressure relief device.)."

Annex 2A, insert a new Appendix 1, to read:

"Annex 2A - Appendix 1

Arrangement of the type-approval mark of non-metallic, metallic or a mixture of metallic and non-metallic LPG components and LPG components containing non-metallic, metallic or a mixture of metallic and non-metallic parts compatible with petrol. The letter N indicates non-metallic components. The letter M indicates metallic components. The letters NM indicates a combination of metallic and non-metallic components. (See paragraph 6.18. of this Regulation)

67 R—012439-NM CLASS #[1]

a ≥ 5 mm

[1] Class 0, 1, 2, 2A or 3

The above approval mark shall be affixed to the LPG component or to an identification plate to be placed in the engine compartment on a visible fixed irreplaceable chassis part, when the component is to be installed in such a way that will no longer be readily accessible.

The approval mark shows that the component has been approved in the Netherlands (E 4), pursuant to UN Regulation No. 67 under approval number 012439. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of UN Regulation No. 67 as amended by the 01 series of amendments."

Annex 2B, item 1, amend to read (keeping the reference to footnote [2] unchanged):

"1. LPG equipment considered:[2]

.....

Pressure/temperature sensor

LPG filter unit

Non-seamless gas tubes and their couplings

Gas tubes made of materials other than copper, stainless steel and steel with corrosion-resistant coating and their couplings

Multi-component"

Annex 2B, Appendix, Table 1, amend to read (inserting a new column for the indication mark of technical modification):

"Table 1

No.	*Item*	*Type*	*Approval No.*	*Extension No.*	*Indication mark(s)*[3]
a	80 per cent stop valve				
b	Level indicator				
c	Pressure relief valve				
d	Remotely controlled service valve with excess valve				
e	Fuel pump				
f	Multi-valve				
g	Gas-tight housing				
h	Power supply bushing				
i	Non return valve				
j	Pressure relief device				

[1] The indication marks of technical modification apply only to Multivalve, or, when approved separately, to Pressure relief valve (discharge valve) and Pressure relief device.

"

Annex 3

Paragraph 1.6., renumber the reference to Annex 15 to read Annex 16 (13 times).

Paragraph 2.6., renumber the reference to Annex 15 to read Annex 16 (10 times).

Paragraph 3.6., renumber the reference to Annex 15 to read Annex 16 (13 times).

Paragraph 4.6., renumber the reference to Annex 15 to read Annex 16 (13 times).

Paragraph 4.7., renumber the reference to Annex 15 to read Annex 16.

Paragraph 5.6., renumber the reference to Annex 15 to read Annex 16 (10 times).

Paragraph 6.6., renumber the reference to Annex 15 to read Annex 16 (4 times).

Paragraph 7.6., renumber the reference to Annex 15 to read Annex 16 (11 times).

Annex 4

Paragraph 6.1., renumber the reference to Annex 15 to read Annex 16.

Paragraph 6.2., renumber the reference to Annex 15 to read Annex 16 (10 times).

Annex 5

Paragraph 6.1., renumber the reference to Annex 15 to read Annex 16 (10 times).

Paragraph 6.2., renumber the reference to Annex 15 to read Annex 16 (6 times).

Annex 6

Paragraph 6.1., renumber the reference to Annex 15 to read Annex 16 (12 times).

Paragraph 6.2., renumber the reference to Annex 15 to read Annex 16 (6 times).

Annex 7

Paragraph 1.6., renumber the reference to Annex 15 to read Annex 16 (12 times).

Paragraph 1.7., renumber the reference to Annex 15 to read Annex 16.

Insert a new paragraph 1.8., to read:

"1.8. If a remotely controlled shut-off valve is used in an interconnected LPG-system, the provisions of paragraph 6.17.3.3. shall apply."

Paragraph 2.6., renumber the reference to Annex 15 to read Annex 16 (12 times).

Insert a new paragraph 2.7., to read:

"2.7. If a non-return valve is used in accordance with paragraph 6.17.14.1. (interconnected LPG-system), the provisions set out in that paragraph shall apply."

Paragraph 3.6., renumber the reference to Annex 15 to read Annex 16 (12 times).

Paragraph 4.6., renumber the reference to Annex 15 to read Annex 16 (12 times).

Annex 8

Paragraph 6., renumber the reference to Annex 15 to read Annex 16 (12 times).

Annex 10

Paragraph 2.6.1. (Bonfire test), amend footnote [1] to read:

"2.6.1. General

The bonfire test is designed to …

…

(h) Same configuration of accessories fitted to the container.[1]

[1] Additional accessories, modifications and extensions of the accessories fitted to the container is possible without retesting, if notified to the Type Approval Authority which approved the container, considered to be unlikely to have an appreciable adverse effect. The Type Approval Authority may require a further test report from the Technical Service responsible. The container and its configurations of accessories will be indicated in the appendix to Annex 2B. Multivalve or, when approved separately, pressure relief valve (discharge valve) and pressure relief device, extended for technical modifications and marked in accordance to Annex 2A need to have a new bonfire test. The container and its configurations of accessories will be indicated in the appendix to Annex 2B."

Annex 11

Paragraph 1.6., renumber the reference to Annex 15 to read Annex 16 (10 times).

Paragraph 2.6., renumber the reference to Annex 15 to read Annex 16 (6 times).

Paragraph 3.6.1., renumber the reference to Annex 15 to read Annex 16 (10 times).

Paragraph 3.6.2., renumber the reference to Annex 15 to read Annex 16 (6 times).

Annex 12

Paragraph 6., renumber the reference to Annex 15 to read Annex 16 (6 times).

Annex 13

Paragraph 6.1., renumber the reference to Annex 15 to read Annex 16 (10 times).

Paragraph 6.2., renumber the reference to Annex 15 to read Annex 16 (6 times).

Annex 14

Insert new paragraphs 6. to 6.4., to read:

"6. When the Electronic Control Unit (ECU) is intended to be fitted as a component of an interconnected LPG-system, it shall inhibit, by controlling the fuel selection system, the vehicle operation in petrol mode after each switch-over operation to LPG mode until a volume of liquid fuel equivalent to that flown into the LPG tank during such an operation is consumed.

Notwithstanding this, the ECU may permit the switch over to petrol mode if a fault in the LPG-system determines the inoperability of the system. Such a fault shall be clearly indicated to the driver.

In case of the inoperability of the LPG-system, a remotely controlled shut-off valve complying with the requirements of paragraph 6.17.3.3. shall be installed along the flow line in order to prevent any flow of petrol into the LPG container after switching-over to petrol mode.

6.1. The maximum volume of liquid fuel that flows during a switch-over operation shall not exceed 0.4 litre and the minimum volume of the tank shall not be lower than 20 litres.

6.2. To verify compliance with paragraph 6. of this annex, the ECU shall be tested as follows:

(a) Install the LPG-system on a vehicle;

(b) Set the fuel selection system in LPG mode;

(c) Warm up the engine until all temperatures of cooling and lubrication means and the pressure of lubrication means have reached equilibrium;

(d) Let the engine run at the lowest idling speed;

(e) Switch over from LPG mode to petrol mode and vice versa;

(f) Set the fuel selection system in petrol mode.

Test interpretation

The criteria adopted for the interpretation of the test is as follows:

(i) Petrol mode is disabled until a volume of liquid fuel equal to 0.4 litre is consumed. Such consumption shall be calculated by a test bench measuring device. It may be calculated making use of the fuel flow signals of the LPG ECU read out by means of an appropriate scan tool, if the reliability of such signals has been previously verified.

The test shall be repeated also at the highest idling speed.

6.3. To measure the volume of liquid fuel that flows during the switch-over operations, the following test shall be carried out:

(a) Install the LPG-system other than the container on a vehicle;

(b) Place the container on a weighing system and fill up the LPG tank;

(c) After having pressurized the LPG-system up to the normal operating conditions, record the reading of the weighing system (W1);

(d) Disable the ECU feature described in paragraph 6. above;

(e) Switch-over from LPG to petrol and vice versa for at least 10 times;

(f) Record the reading of the weighing system (W2).

The volume of petrol flown per switch-over operation shall be calculated as follows:

Vsw = (W2-W1) / #SW / Dpetrol

where:

Dpetrol = 743 kg/m^3;

#SW = number of switch-over operations from LPG to petrol mode and vice versa during the test.

The weighing system shall have the following:

(a) A precision of ± 0.02 per cent of full scale or better;

(b) A resolution of 20 g;

(c) An accuracy of ± 2 per cent of the reading or ± 0.3 per cent of full scale whichever is better.

6.4. The ECU shall bear a marking with the following data clearly legible and indelible:

(a) the wording "ICS"; and

(b) the value of 0.4 litre; and

(c) the approval mark according to paragraph 5.4. of this Regulation."

Insert a new Annex 15, to read:

"Annex 15

Provisions regarding the approval of gas tube(s) of non-seamless type, gas tube(s) made of materials other than copper, stainless steel, and steel with corrosion-resistant coating, and their couplings

1. Definitions:

Gas tube: gas tube as defined in paragraph 2.21. of this Regulation.

2. Component classification (according to paragraph 2., Figure 1):

Gas tube and its coupling(s) can be of Class 0, 1, 2 or 2A.

3. Classification pressure:

Parts of Class 0:	WP declared
Parts of Class 1:	3,000 kPa
Parts of Class 2:	450 kPa
Parts of Class 2A:	120 kPa

4. Design temperatures:

-20 °C to 120 °C

For temperatures exceeding the above-mentioned values, special tests conditions are applicable.

5. General design rules:

The couplings shall be compatible with the gas tube.

Specific care shall be taken against galvanic corrosion.

Stainless steel gas tube shall only be used in combination with stainless steel couplings.

Only straight longitudinal welding (in the direction of the tube itself) is permitted in gas tubes of non-seamless type.

6. Applicable test procedures:

6.1. For parts of Classes 0 and 1:

Overpressure test	Annex 16, para. 4.
External leakage	Annex 16, para. 5.
High temperature	Annex 16, para. 6.

	Low temperature	Annex 16, para. 7.
	LPG compatibility	Annex 16, para. 11.**
	Corrosion resistance	Annex 16, para. 12.[1]
	Resistance to dry heat	Annex 16, para. 13.**
	Ozone ageing	Annex 16, para. 14.**

6.2. For parts of Class 2 or 2A:

	Overpressure test	Annex 16, para. 4.
	External leakage	Annex 16, para. 5.
	High temperature	Annex 16, para. 6.
	Low temperature	Annex 16, para. 7.
	LPG compatibility	Annex 16, para. 11.**
	Corrosion resistance	Annex 16, para. 12.[2]

6.3. Specific requirements on the gas tube and its couplings:

6.3.1. Endurance test

The gas tube and its coupling(s) shall be tested for an endurance test consisting out of 100,000 cycles.

One cycle consist out of pressure ramp from 15 per cent WP up to WP.

After the endurance test, the gas tube and its coupling(s) need to comply with the leakage test of Annex 16, paragraphs 5., 6. and 7 and with the overpressure test according to Annex 16, paragraph 4.

6.3.2. Bending test on the gas tube

Test the gas tube according to the following procedure and acceptance criteria.

(a) Select a mandrel with an external diameter from the below table:

External diameter	*Mandrel diameter*
≤ 8 mm	3 times the external gas tube diameter
> 8 mm	5 times the external gas tube diameter

(b) Bend the gas tube over this mandrel once, forming a "U" shape.

(c) Close the ends of the gas tube and subject it to the overpressure test according to Annex 16, paragraph 4.

At the completion of the overpressure test, the gas tube shall be tested according to the leakage test of Annex 16, paragraphs 5., 6. and 7.

[1] Only for metallic parts.
[2] Only for metallic parts.
** Only for non-metallic parts.

6.3.3. Excess torque resistance

A coupling designed to be connected directly to threaded fittings shall be capable of withstanding, without deformation, breakage or leakage, a torque effort of 150 per cent of the rated installation value delivered by the manufacturer, according to the following test procedure:

(a) Test an unused component, applying the torque adjacent to the fitting.

(b) For a component having a threaded connection or threaded connections, apply the turning effort for 15 minutes, release the turning effort, then remove the component and examine it for deformation and breakage.

(c) Perform the leakage test according to Annex 16, paragraphs 5., 6. and 7.

(d) Perform the overpressure test according to Annex 16, paragraph 4.

6.3.4. Vibration test

Vibrate the gas tube and its coupling(s) according to the test described in Annex 16, paragraph 10.5.4., procedure A.

After this test the gas tube and its coupling(s) need to comply with the leakage test of Annex 16, paragraphs 5., 6. and 7. and with the overpressure test according to Annex 16, paragraph 4.

6.3.5. Pull-off

Test the gas tube and its coupling(s) according to the following procedure and acceptance criteria.

Secure the subject specimen in an appropriate test fixture, then statically apply a tensile load along the gas tube axis at a maximum rate of 250 N/min until the gas tube separates from the coupling(s).

The force (F), in Newton, required to pull apart the gas tube from its coupling(s) shall be that calculated as:

$F = (\pi \cdot d^2 \cdot P)/10$

where

d is the internal diameter, in millimetres;

P is the maximum working pressure, in bar.

6.3.6. Brass material compatibility

All gas tubes and its couplings having brass components shall be subjected to the brass material compatibility test according to Annex 16, paragraph 12.2.

After this test the gas tube and its coupling(s) need to comply with the leakage test of Annex 16, paragraphs 5., 6. and 7 and with the overpressure test according to Annex 16, paragraph 4."

Annex 15 (former), renumber as Annex 16 and insert new paragraphs 9.7. and 9.7.1., to read:

"9.7. Endurance test for non-return valves in interconnected LPG-systems

9.7.1. The non-return valve shall be able to withstand 20,000 cycles of operation and 24 hours of chatter flow when tested according to the following procedure:

(a) Connect the valve to a test fixture and apply a pressure to the valve's inlet equal to pressure of 3,000 kPa or of WP in accordance with the classification pressure of the valve, then vent pressure from its outlet. Lower the pressure on the valve's outlet side to between 0 and a maximum of 0.5 times the above value prior to the next cycle.

(b) Following 20,000 cycles of operation, subject the valve to 24 hours of chatter flow at a flow rate that causes the most chatter.

After this test, the non-return valve shall comply with the applicable leakage test requirements of paragraphs 5. and 8. above.

Failure in any sense during the procedure shall constitute a failure of the non-return valve.

All parts shall remain in position and function properly after this test.

Following this test, the check valve shall comply with the overpressure test according to paragraph 4."

Annex 16 (former), renumber as Annex 17.

Annex 17 (former), renumber as Annex 18.

Insert a new Annex 19, to read:

"Annex 19

Provisions on the compatibility of metallic and non-metallic components and parts with petrol

1. Requirements for metallic and non-metallic components and parts

1.1. Non-metallic components or parts which may come into contact with petrol shall not show excessive volume change or loss of weight.

Resistance to petrol according to ISO 1817 with the following conditions:

(a) Medium: petrol (E10) complying with Annex 10 to UN Regulation No. 83;

(b) Temperature: 23 °C (tolerance according to ISO 1817);

(c) Immersion period: 72 hours.

1.1.1. Requirements for non-metallic components and parts:

Maximum change in volume 20 per cent;

After storage in air with a temperature of 40 °C for a period of 48 hours, the mass compared to the original value may not decrease more than 5 per cent.

1.3. Metallic components or parts which may come into contact with petrol shall have a permanent resistance against petrol. Metallic parts shall permanently be protected against corrosion (e.g. coating, surface finish, material mix) and fulfil the requirements of Annex 16, paragraph 12."

Insert a new Annex 20, to read:

"Annex 20

Provisions on interconnected LPG-systems

1. Documentation

1.1. The following documentation shall be provided to the Type Approval Authority and to the Technical Service:

(a) A list of all parts of specific equipment mentioned in paragraph 2.2. of this Regulation including the approval documentation that are part of a multi-component according to paragraph 2.23. of this Regulation, if available in the system;

(b) The description of the means used to ensure compliance with the requirements specified in paragraph 17.13.2.3. of this Regulation, including all equipment, monitored parameters, relevant factors, criteria and actions;

(c) A detailed flowchart that depicts the strategies used for the purposes of meeting the requirements specified in paragraph 17.13.2.3. of this Regulation.

2. Test procedures

2.1. In order to verify compliance with paragraph 17.13.2.3. of this Regulation, a vehicle shall be tested as follows:

Test procedure

(a) Install the LPG equipment on the vehicle;

(b) Fill up the LPG tank with at least 10 litres of fuel;

(c) Set the fuel selection system in LPG mode;

(d) Let the engine run at the lowest idling speed;

(e) Switch over from LPG mode to petrol mode and vice versa;

(f) Repeat the action (e) until the disablement of petrol mode becomes permanent.

Test interpretation

The criteria adopted for the interpretation of the test is as follows:

$$Nsw < 0.16 * Vin / Vsw$$

where:

Nsw = the number of switch-over operations from LPG mode to petrol mode and vice versa until the disablement of petrol mode becomes permanent.

Vsw = the volume of petrol flown into the LPG tank per switch-over operation as measured in paragraph 6.1. of Annex 14 to this Regulation.

Vin = the initial volume of LPG according to paragraph 2.1.(b) of this annex above."